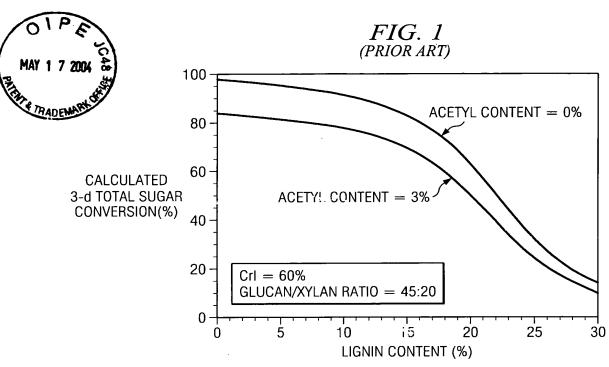
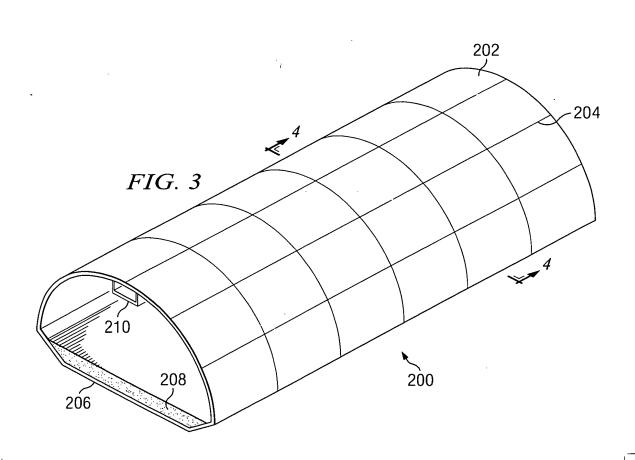
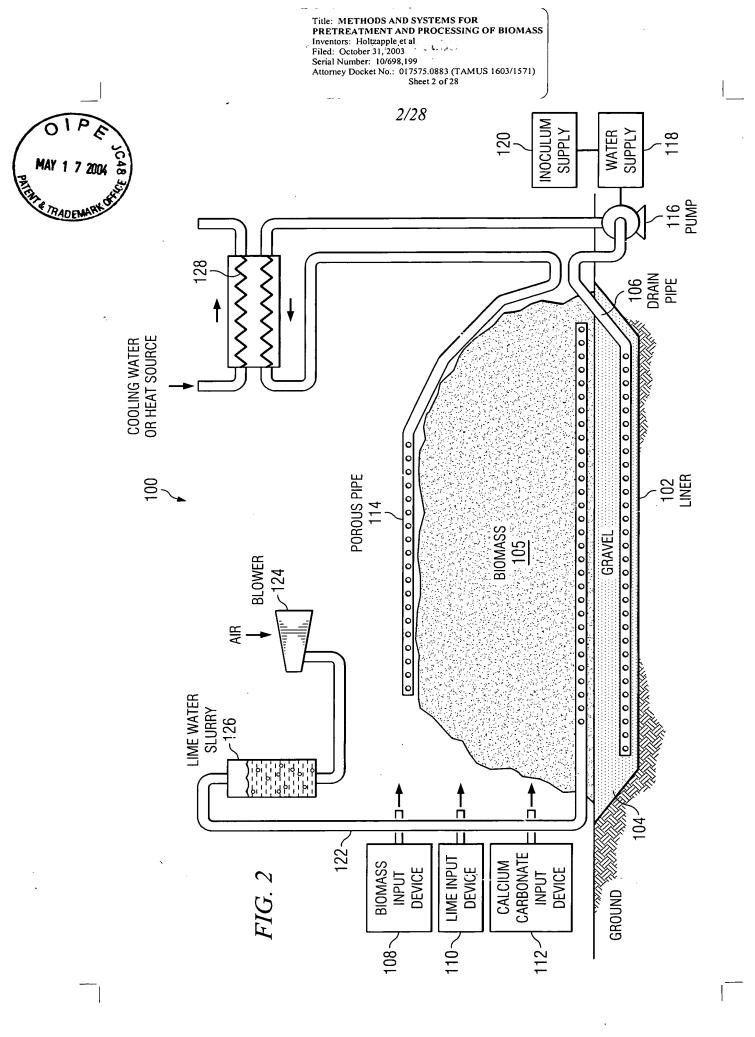
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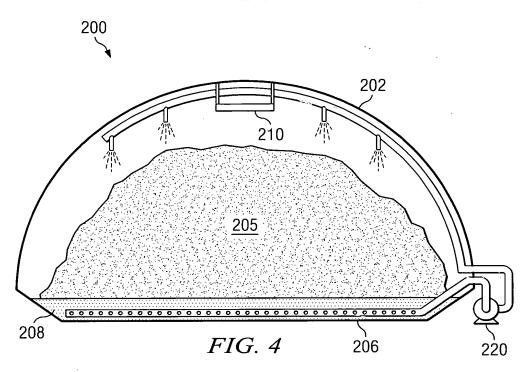


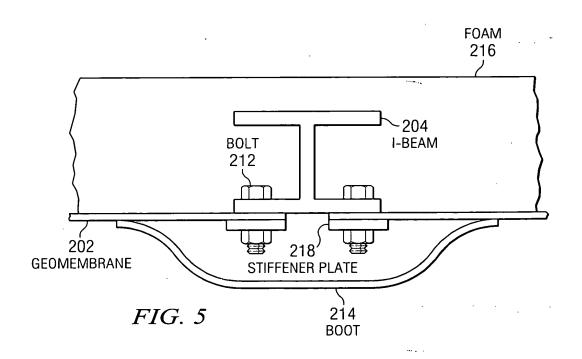




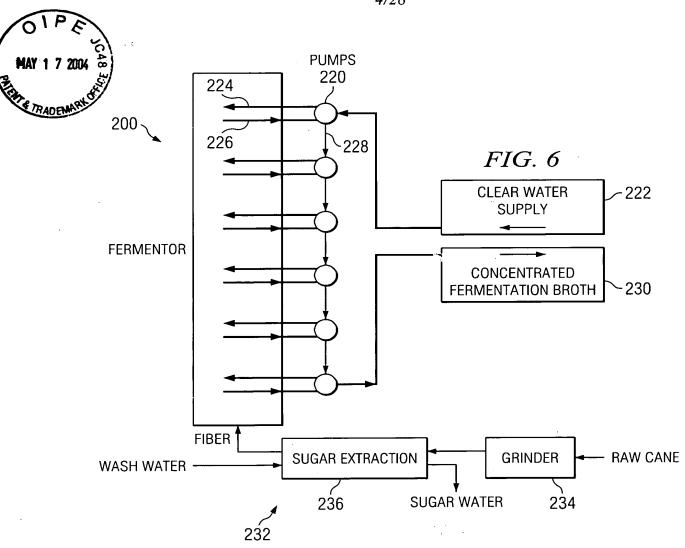
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Inventors: Holtzapple et al
Filed: October 31, 2003
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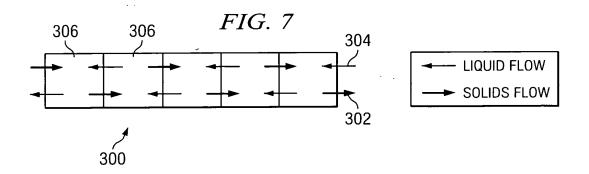






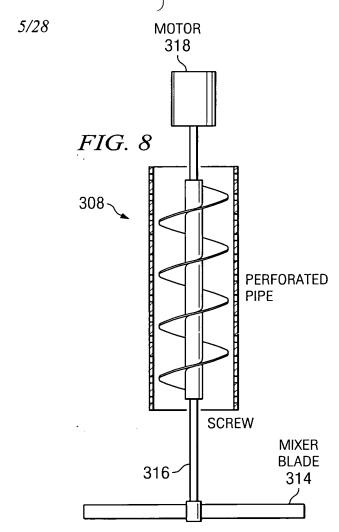
PRETREATMENT AND PROCESSING STATE Inventors: Holtzapple et al State Stat

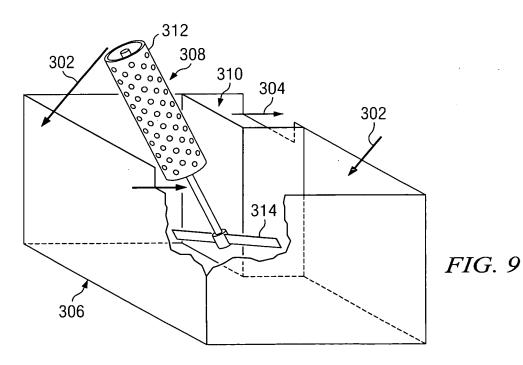




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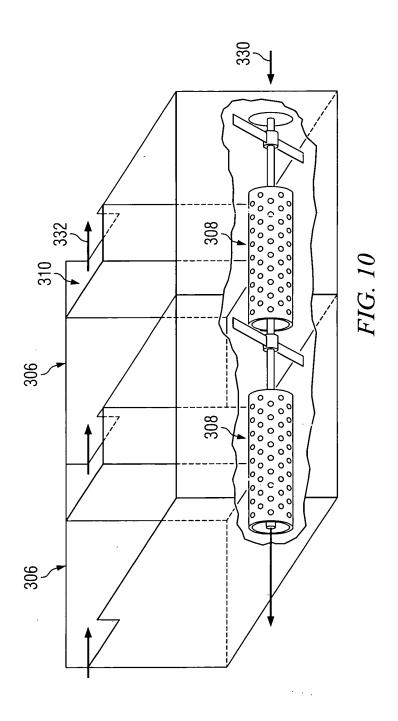




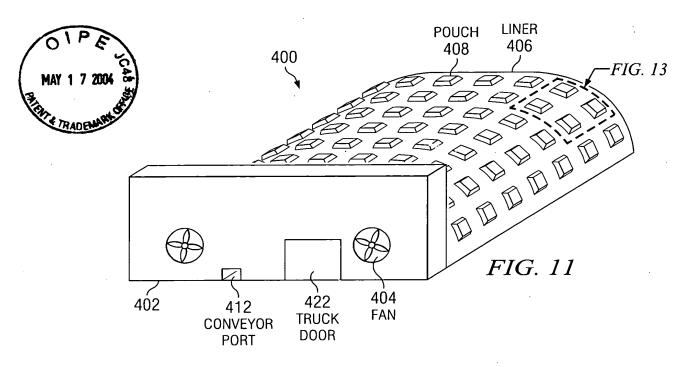
Title: METHODS AND SYSTEMS FOR
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Filed: October 31, 2003
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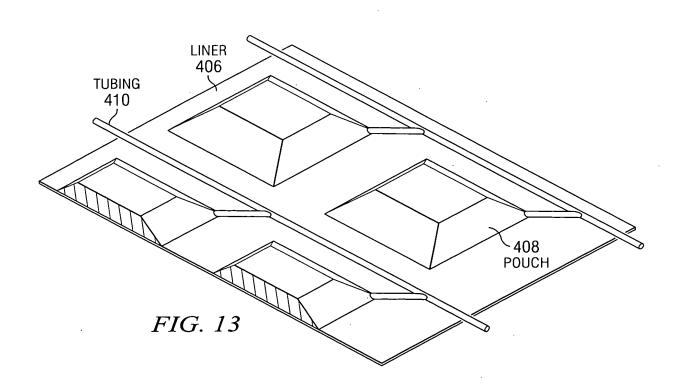


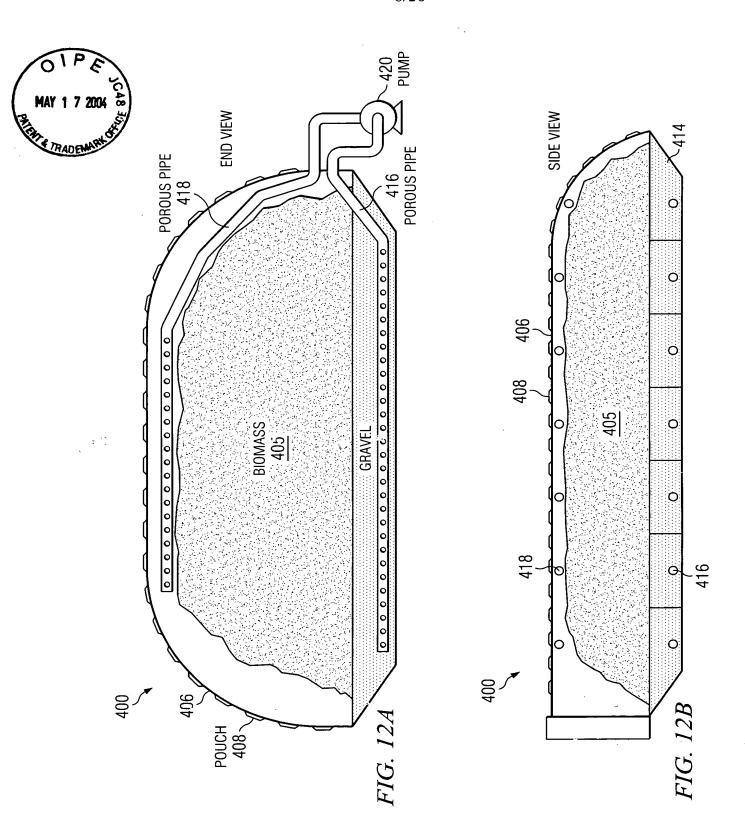




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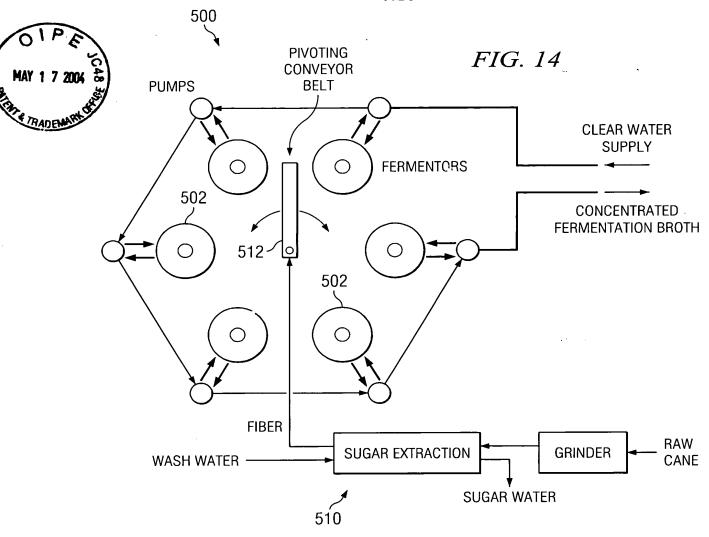


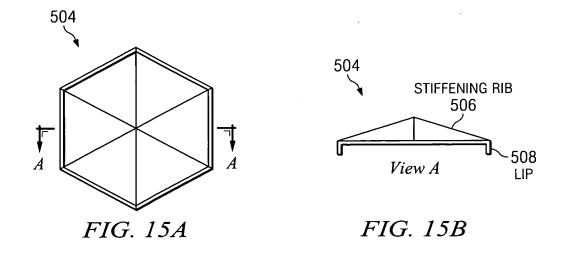




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Sheet 10 of 28 10/28 512 FIG. 16 600 604 604 604 **OUTPOST** OUTPOST **OUTPOST** CENTRAL PLANT 602 OUTPOST OUTPOST OUTPOST 604 604 IN **OUT** FIG. 17 6<u>0</u>4 AIR AIR FIG. 18 **BAGASSE** LIME AND WATER

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FRACTION REMAINING **IN SAMPLE** (g COMPONENT/g DRY OF UNTREATED BAGASSE)

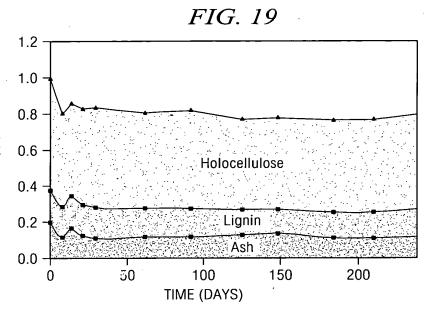
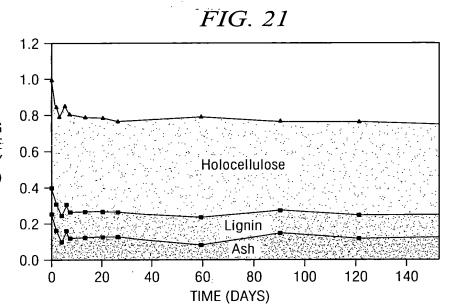


FIG. 20 1.2 1.0 8.0 FRACTION REMAINING **IN SAMPLE** 0.6 (g COMPONENT/g DRY OF UNTREATED BAGASSE) Holocellulose 0.4 Lignin 0.2 Ash 0.0 200 50 100 150 TIME (DAYS)

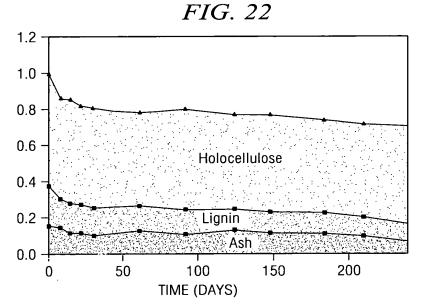
Inventors: Holtzapple et al Filed: October 31, 2003 Serial Number: 10/698,199 Attorney Docket No.: 017575.0883 (TAMUS 1603/1571) Sheet 12 of 28



FRACTION REMAINING IN SAMPLE (g COMPONENT/g DRY OF UNTREATED BAGASSE)



FRACTION REMAINING **IN SAMPLE** (g COMPONENT/g DRY OF UNTREATED BAGASSE)



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FRACTION REMAINING **IN SAMPLE** (g COMPONENT/g DRY OF UNTREATED BAGASSE)

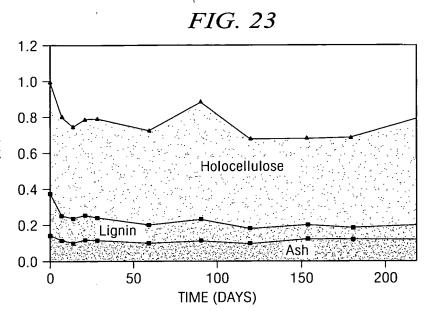
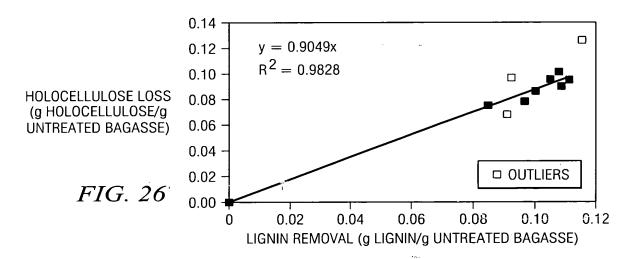
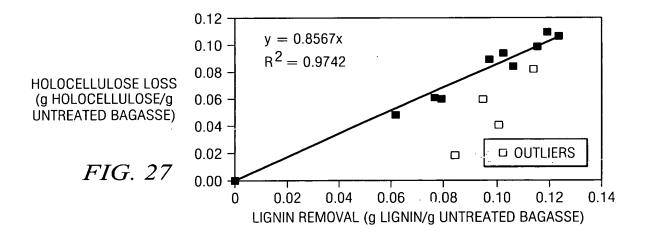


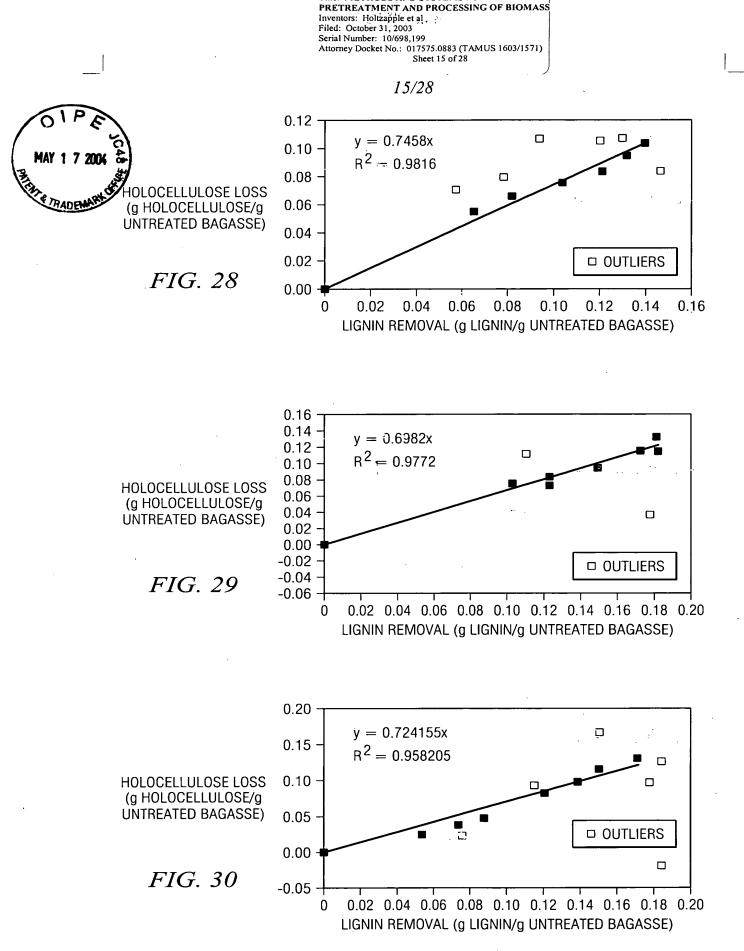
FIG. 24 1.2 1.0 8.0 FRACTION REMAINING IN SAMPLE 0.6 (g COMPONENT/g DRY OF UNTREATED BAGASSE) Holocellulose 0.4 0.2 Ash 0.0 -80 100 40 60 120 140 20 TIME (DAYS)

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Serial Number: 10/698,199 Attorney Docket No.: 017575.0883 (TAMUS 1603/1571) Sheet 16 of 28 16/28 30 25 NO AIR (CAPPED) 20 LIGNIN CONTENT IN TREATED BAGASSE 15 (g LIGNIN/100 g OF TREATED BAGASSE) 10 AIR 5 FIG. 31 0 50 100 200 250 150 300 0 TIME (DAYS) 30 25 NO AIR (CAPPED) 20 LIGNIN CONTENT IN TREATED BAGASSE 15 (g LIGNIN/100 g OF TREATED BAGASSE) 10 **AIR** 5 FIG. 32 0 -50 200 0 100 150 250 TIME (DAYS) 30 25 NO AIR N_ວ PURGED) NO AIR 20 (CAPPED) LIGNIN CONTENT IN TREATED BAGASSE 15 (g LIGNIN/100 g OF BAGASSE) 10 5 AIR FIG. 33 0 80 20 60 100 120 140 160 0 40 180 TIME (DAYS)

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Serial Number: 10/698,199 Attorney Docket No.: 017575.0883 (TAMUS 1603/1571) Sheet 17 of 28 17/28 30 25 20 LIGNIN CONTENT IN TREATED BAGASSE 15 50°C (g LIGNIN/100 g OF TREATED BAGASSE) 10 5 FIG. 34 0 50 100 150 200 250 300 0 TIME (DAYS) 30 25 20 LIGNIN CONTENT IN TREATED BAGASSE 15 (g LIGNIN/100 g OF BAGASSE) 10 50°C 5 FIG. 35 0 50 100 150 200 250 300 0 TIME (DAYS) 0.50 0.45 AIR 0.40 0.35 LIGNIN CONVERSION 0.30 (g LIGNIN REMOVED/g 0.25 LIGNIN IN UNTREATED 0.20 NO AIR **BAGASSE)** (CAPPED) 0.15 0.10 0.05 FIG. 36 0 100 200 300 50 150 250 0 TIME (DAYS)

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Sheet 19 of 28 19/28 .40 y = 1.839E-03x + 6.550E-02.35 $R^2 = 9.949E-01$.30 .25 LIME CONSUMPTION (g Ca(OH)2 CONSUMED/g .20 **UNTREATED BAGASSE)** .15 .10 NO AIR (CAPPED) FIG. 40 .05 0 20 40 60 80 100 120 140 160 0 180 TIME (DAYS) .45 HIGH FLOW OF AIR, .40 THUS CO2 IN THE AIR .35 AIR CAUSED TIME TO BE .30 **CONSUMED FASTER** LIME CONSUMPTION .25 (g Ca(OH)₂ CONSUMED/g .20 **UNTREATED BAGASSE)** FLOW OF AIR .15 **INCREASED HERE** NO AIR .10 (CAPPED) FIG. 41 .05 0 200 0 50 100 150 250 300 TIME (DAYS) .40 .35 .30 .25 SUGAR YIELD NO AIR (g GLUCOSS + XYLOSE/g .20 (CAPPED) DRY OF UNTREATED **BIOMASS**) .15 .10 FIG. 42 .05 0 50 100 150 200 250 300 0 TIME (DAYS)

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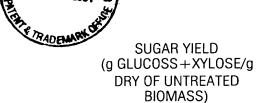
Filed: October 31, 2003 Serial Number: 10/698,199 Attorney Docket No.: 017575.0883 (TAMUS 1603/1571) Sheet 20 of 28 20/28 .45 .40 NO AIR .35 (CAPPED) .30 **SUGAR YIELD** .25 g GLUCOSS + XYLOSE/g **AIR** DRY OF UNTREATED .20 BIOMASS) .15 .10 FIG. 43 .05 0 -200 50 100 150 250 0 TIME (DAYS) .45 NO AIR .40 (CAPPED) .35 .30 **SUGAR YIELD** AIR (g GLUCOSS + XYLOSE/g .25 DRY OF UNTREATED .20 **BIOMASS**) .15 .10 FIG. 44 .05 0 40 60 80 100 120 140 160 180 0 20 TIME (DAYS) .45 .40 57°C .35 .30 SUGAR YIELD (g GLUCOSS + XYLOSE/g .25 ▲ 25°C DRY OF UNTREATED .20 **BIOMASS**) .15 .10 FIG. 45 .05 0 50 100 150 200 250 300 0 TIME (DAYS)

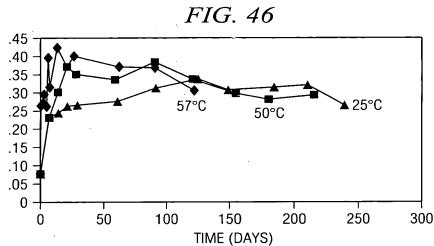
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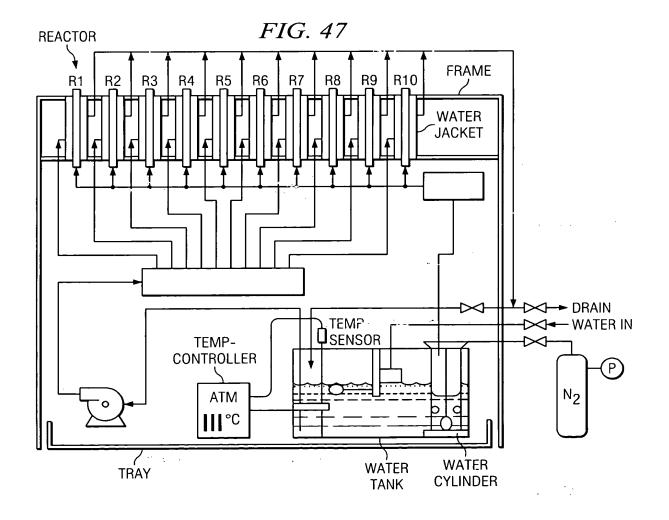
Inventors: Holtzapple et al-

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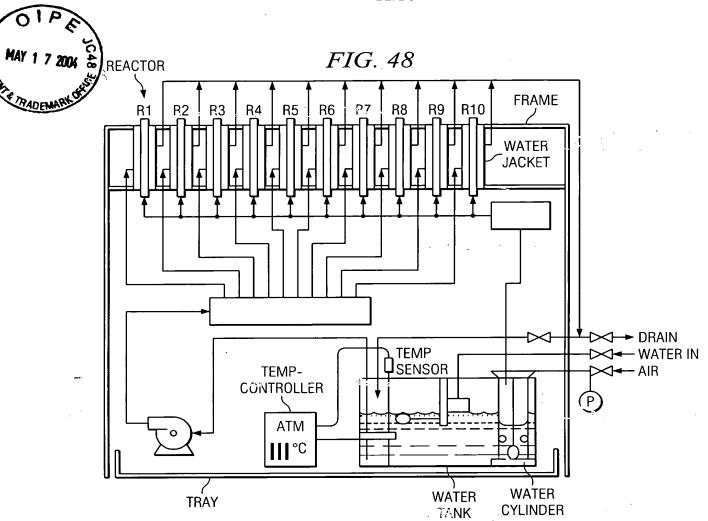


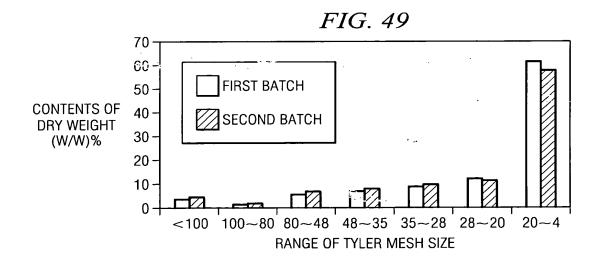


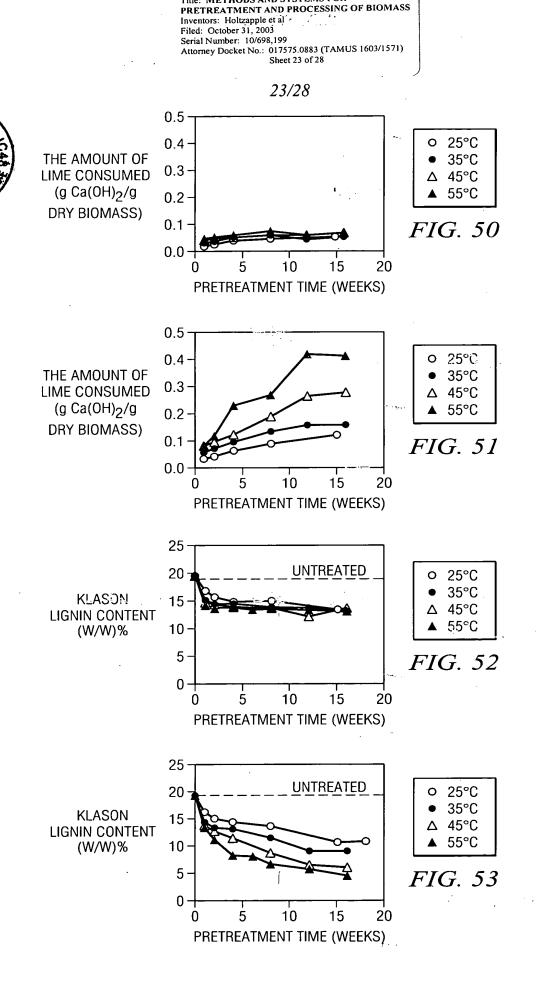


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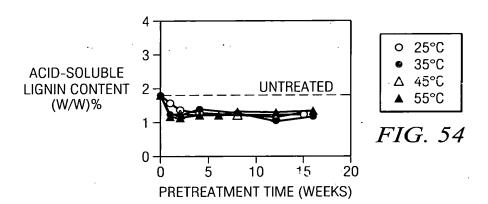
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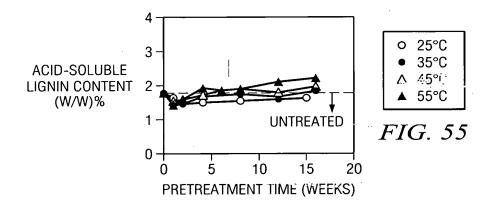
Inventors: Holtzapple et al

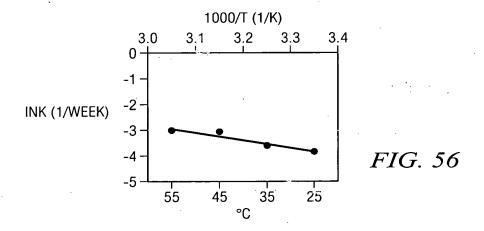
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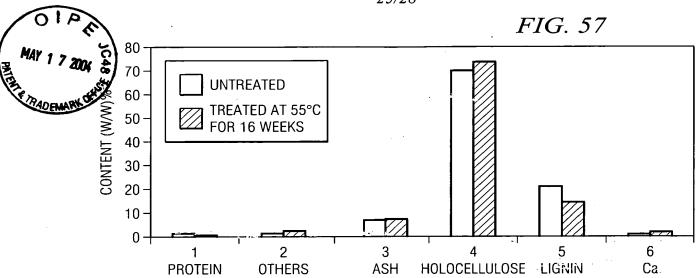


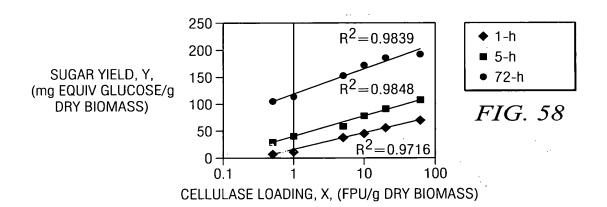


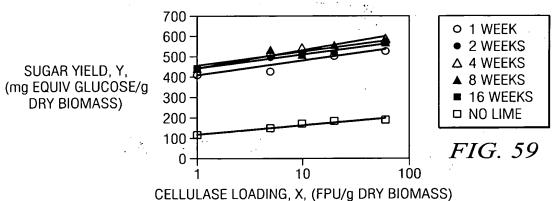
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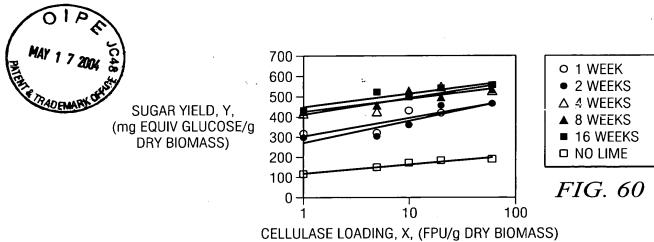
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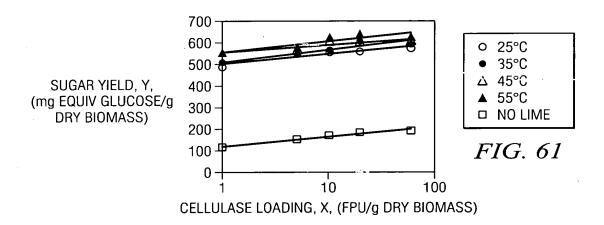
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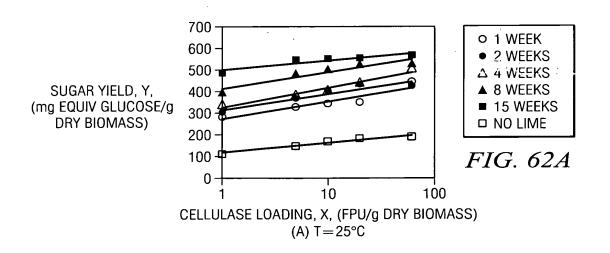
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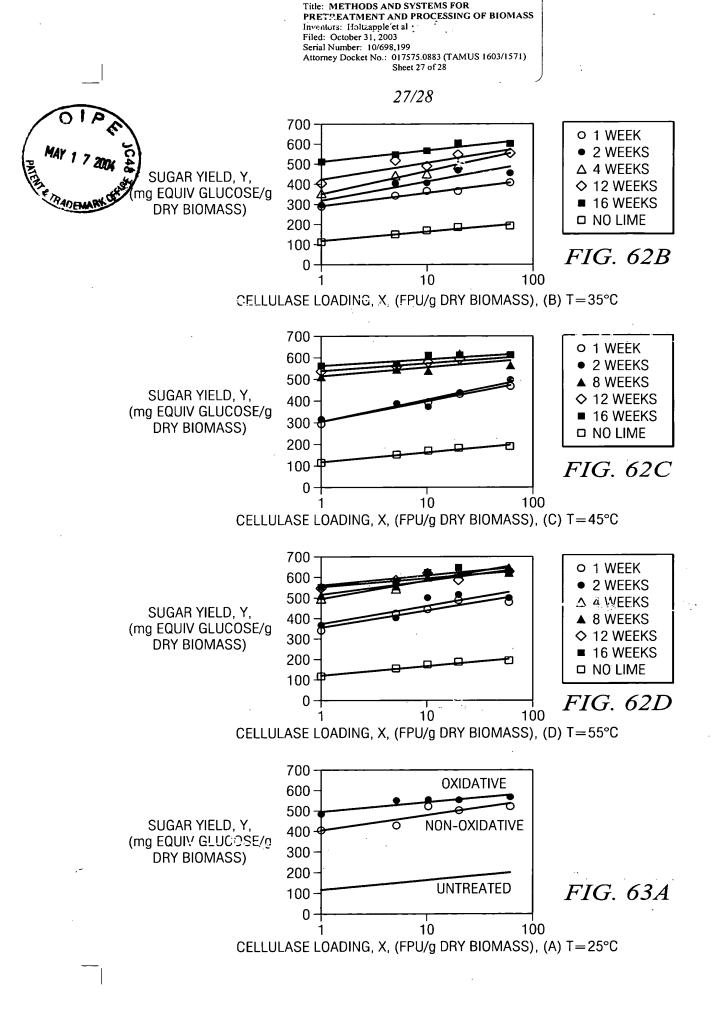
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0.0

12

8

PRETREATMENT TIME (WEEKS)

16